QUESTIONS

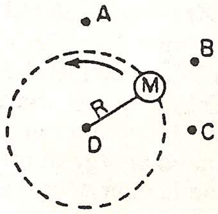
1. What is the weight of a 5.00-kilogram mass at the Earth's surface? (1) 5.00 N (2) 14.7 N (3) 49.0 N (4) 147 N
2. As a satellite is accelerated away from the Earth by a rocket, the satellite's mass (1) decreases (2) increases (3) remains the same
3. Two objects of fixed mass are moved apart so that they are separated by three times their original distance. Compared to the original gravitational force between them, the new gravitational force is (1) one-third as great (2) one-ninth as great (3) three times greater (4) nine times greater
4. A 50-kilogram student, standing on the Earth, attracts the Earth with a force closest to (1) 0 newtons (2) 5 newtons (3) 50 newtons (4) 500 newtons
5. Two point masses that are equal are separated by a distance of 1 meter. If one mass is doubled, the gravitational force between the two masses would be (1) one-half as great (2) two times greater (3) one-fourth is great (4) four times greater
6. What is the weight of a 10. kilogram object at the surface of the Earth? (1) 10. kg (2) 49N (3) 98 N (4) 49 kg
7. Which two quantities are measured in the same units? (1) velocity and acceleration (2) weight and force (3) mass and weight (4) force and momentum
8. An 800-newton person is standing in an elevator. If the upward force of the elevator on the person is 600 newtons, the person is (1) at rest (2) accelerating upward (3) accelerating downward (4) moving downward at constant speed
9. Two objects of equal mass are a fixed distance apart. If the mass of each object could be tripled, the gravitational force between the objects would (1) decrease by one-third (2) decrease by one-ninth (3) triple (4) increase 9 times
10. A space probe has a mass of 5.0 kg on the surface of the earth. What is its mass when it is at a place where the gravitational field strength is 2.0 N/kg? 1) 2.5 kg 2) 5.0 kg 3) 7.0 kg 4) 10. kg
11. An astronaut has a mass of 60. kilograms and weighs 12 newtons out in space. What is the gravitational field strength at her location? 1) 0.20 N/kg 2) 5.0 N/kg 3) 48 N/kg 4) 72 N/kg

Friction

Friction is a force that opposes motion between particles of solids, liquids, or gases that come into contact. In solids it

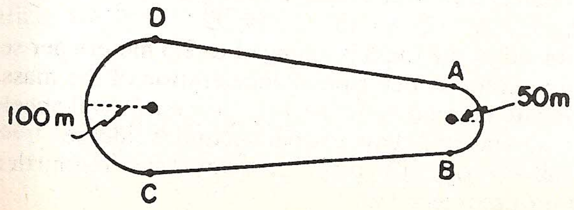
QUESTIONS

Base your answers to questions 1 through 5 on the diagram below which represents a ball of mass *M* attached to a string. The ball moves at a constant speed around a flat horizontal circle of radius *R*.



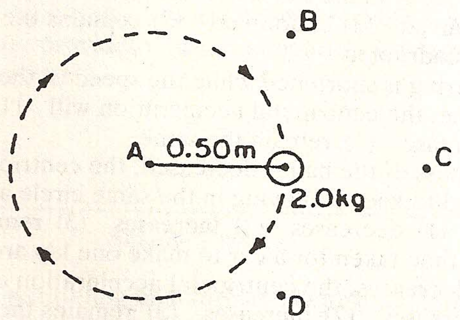
1. When the ball is in the position shown, the direction of the centripetal force is toward point (1) A (2) B (3) C (4) D
2. The centripetal acceleration of the ball is (1) zero (2) constant in direction, but changing in magnitude (3) constant in magnitude, but changing in direction (4) changing in both magnitude and direction
3. If the velocity of the ball is doubled, the centripetal acceleration (1) is halved (2) is doubled (3) remains the same (4) is quadrupled
4. If the string is shortened while the speed of the ball remains the same, the centripetal acceleration will (1) decrease (2) increase (3) remain the same
5. If the mass of the ball is decreased, the centripetal force required to keep it moving in the same circle at the same speed (1) decreases (2) increases (3) remains the same
6. As the time taken for a car to make one lap around a circular track decreases, the centripetal acceleration of the car (1) decreases (2) increases (3) remains the same

Base your answers to questions 7 through 11 on the diagram below which represents a flat racetrack as viewed from above, with the radii of its two curves indicated. A car with a mass of 1,000 kilograms moves counterclockwise around the track at a constant speed of 20 meters per second.



7. The net force acting on the car while it is moving from A to D is (1) 0 N (2) 400 N (3) 8,000 N (4) 20,000 N
8. The net force acting on the car while it is moving from D to C is (1) 0 N (2) 200 N (3) 4,000 N (4) 20,000 N
9. If the car moved from C to B in 20 seconds, the distance CB is (1) 100 m (2) 200 m (3) 300 M (4) 400 m
10. Compared to the centripetal acceleration of the car while moving from B to A, the centripetal acceleration of the car while moving from D to C is (1) the same (2) twice as great (3) one-half as great (4) 4 times greater
11. Compared to the kinetic energy of the car while moving from A to D, the kinetic energy of the car while moving from D to C is (1) less (2) greater (3) the same

Base your answers to questions 12 through 15 on the diagram below which represents a 2.0-kilogram mass moving in a circular path on the end of a string 0.50 meter long. The mass moves in a horizontal plane at a constant speed of 4.0 meters per second.



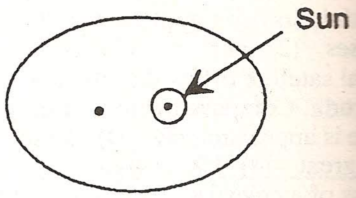
12. The force exerted on the mass by the string is (1) 8 N (2) 16 N (3) 32 N (4) 64 N
13. In the position shown in the diagram, the momentum of the mass is directed toward point (1) A (2) B (3) C (4) D
14. The centripetal force acting on the mass is directed toward point (1) A (2) B (3) C (4) D
15. The speed of the mass is changed to 2.0 meters per second. Compared to the centripetal acceleration of the mass when moving at 4.0 meters per second, its centripetal acceleration when moving at 2.0 meters per second would be (1) half as great (2) twice as great (3) one-fourth as great (4) four times as great

III. Kepler's Laws

Johannes Kepler formulated three laws that provide explanations for planetary motions. Previously, astrono described each planet's orbit as complicated combination

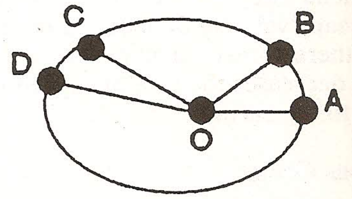
A. Kepler's First Law.

The shape of each planet's orbit is an ellipse. The sun at a focus of this ellipse.



B. Kepler's Second Law

If a line is drawn between the centers of the sun and the line will sweep the same area in space for any given time. For example, assume that AB and CD are distance by a planet in a month's time. Sector areas AOB and C equal. Planets always move faster when closer to the su



C. Kepler's Third Law

The time need for a planet to orbit the sun (its period on the mean distance between the planet and the sun. T marized by the relationship:

$$\frac{R^3}{T^2} = K$$

Where: R is the mean distance between the planet and
T is the period of the planet
K is a constant for any planet that orbits the s